Plug-in Vehicle History and Status

A Presentation to the California Air Resources Board
ZEV Technical Review Panel

September 27, 2006

ZEV Mandate Produced Real ZEVs

	Leased/Sold	On Road Today
 Toyota RAV4-EV	1485	820
 Ford Ranger EV	1312	~400
 GM EV-1	800	0 [2]
 Ford Postal Van	495	0
 Chevrolet S-10 Electric	450	55
 Ford Th!nk City	440	~100 [3]
 Honda EV Plus	300	0 [2]
 Chrysler EPIC Mini-Van	207	5
 Nissan Altra	130	0 [2]
 Nissan Hypermini	50	0 [2]
 Toyota eCom	15	0 [2]
	5599 [1]	1380

Source: Various industry and private sources

[1] nationwide deployments of vehicles resulting from ZEV regulation.
CA deployments = 4400

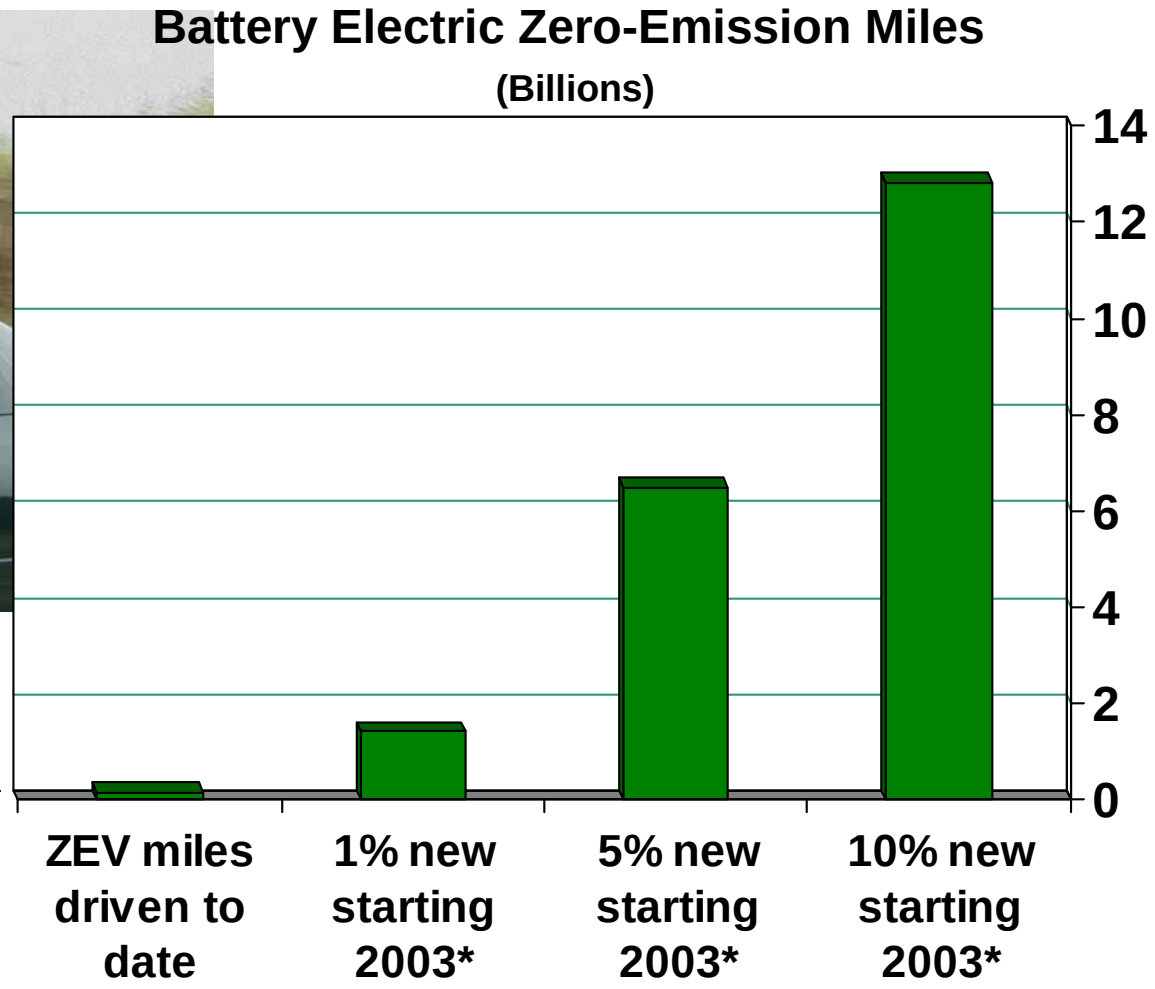
[2] excludes small numbers potentially still in use by OEMs for testing

[3] redeployed in Norway – none on US roads

PLUG IN AMERICA

CARB Mandate Plug-in Zero-Emission Miles: Achievement & Promise

154,000,000 CARB-mandated ZEV Miles



*** Assuming mandate had resulted in new ZEV sales starting in 2003**

PLUG IN AMERICA

Emissions Avoided*

- Battery Electric ZEV miles to date:
  - 2.3 billion pounds of CO2
  - 257 million grams CO
  - 778 thousand grams NOx
- If 1% of sales in 2003 were ZEVs:
  - 21 billion pounds of CO2
  - 2.4 billion grams CO
  - 7.2 million grams NOx
- If 10% of sales in 2003 were ZEVs:
  - 189 billion pounds of CO2
  - 21 billion grams CO
  - 65 million grams NOx

***Well-to-wheels comparison, with charging on California electrical grid**

PLUG IN AMERICA

Sources: CARB LEV II Exhaust Emission Standards
Argonne National Labs GREET 1.6 Fuel-Cycle Model for Transportation Fuels… June 2001

Positive User Experiences

- BEV driver experience overwhelmingly positive
  - home charging a major benefit
    - safe, convenient, reliable
  - public charging useful for occasional longer trips
  - lower refueling and operating costs
  - less regular maintenance
    - no oil changes
    - no smog checks

- Purchase/lease experience often was largest negative
  - cumbersome sales process, long waits for vehicles
- Repairs, in general, resulted from implementation issues, not intrinsic technology issues
- NiMH batteries have proven very reliable in real world driving
  - robust, predictable, durable

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Consumers Want Plug-in Cars

- 33% of new car buyers serious about alternative-fuel cars, and 92% of these willing to pay $9,258 extra for one

The Wall Street Journal / Harris Interactive Poll 2006

- 75% have heard of plug-in hybrids, 55% think they're good idea

Opinion Research Corp. 2005

- 3 to 5 year-old RAV4-EVs are currently selling for a premium of $10K to $20K over the original retail price without any rebates or tax incentives

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City of Austin, Texas

www.pluginpartners.org

- 6,900 “soft” fleet orders gathered
- 32 U.S. cities signed on, orders pending
- 18 counties and local governments
- 2 biofuel associations
- 56 environmental and security groups
- 12 businesses
- 126 public and private utilities

The Straus Family Creamery

- Marin County, CA
- 2002 RAV4-EV
- 56,000 zero-emission miles
- Personal transportation and farm utility vehicle

- Farm's methane digester powers RAV4-EV and farm equipment
- No repair issues other than flat tires

PLUG IN AMERICA

Avi Hershkovitz

- Claremont, Ca
- 2002 RAV4-EV
- 105,135 zero-emission miles

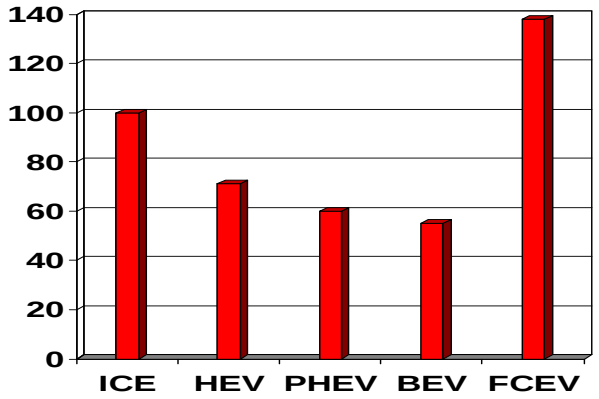
- Used as primary vehicle including 100-150 mile per day commute every working day
- No discernable loss of range after more than 100,000 miles

PLUG IN AMERICA

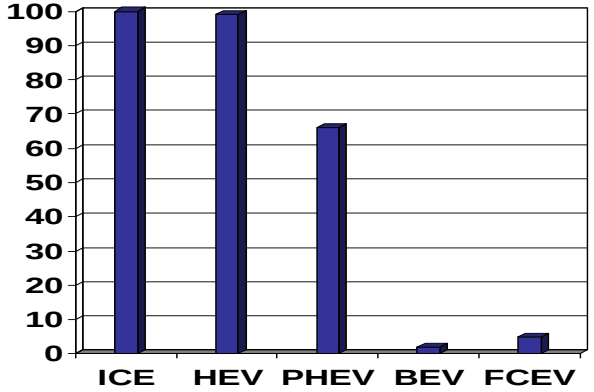
BEVs Really Do Produce Less Emissions

Well-to-wheels emissions based on total US electrical grid

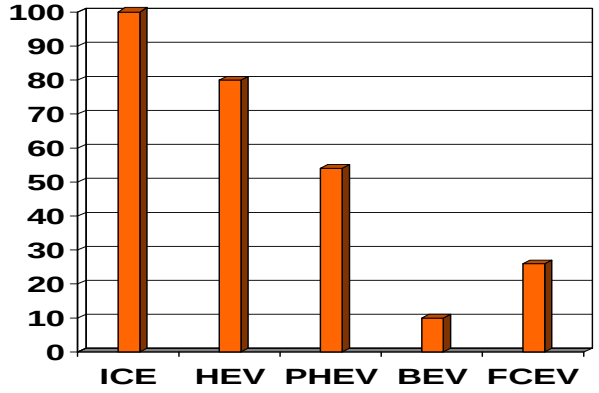
Carbon Dioxide



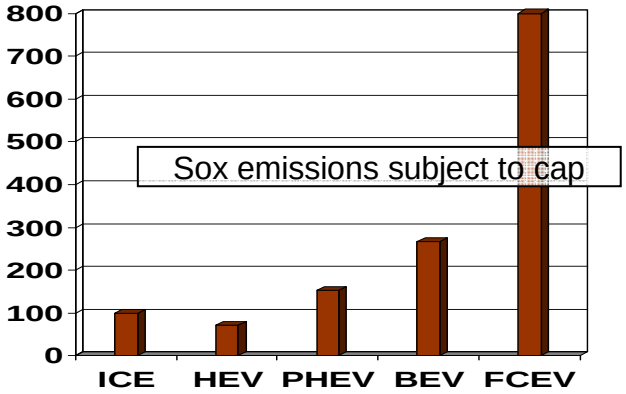
Carbon Monoxide



Volatile Organic Compounds



Sulfur Oxides*



*** EV Charging on US grid should not result in additional SO2 emissions due to regulatory emission caps on stationary sources already in place**

PLUG IN AMERICA

Sources: Argonne National Labs GREET 1.6 Fuel-Cycle Model for Transportation Fuels… June 2001
FCEV based on US grid powered electrolysis fuel cycle

Plug-in Vehicles and Renewable Energy

- Plug-in Vehicles are the only practical vehicles that can be charged from renewable energy produced at home

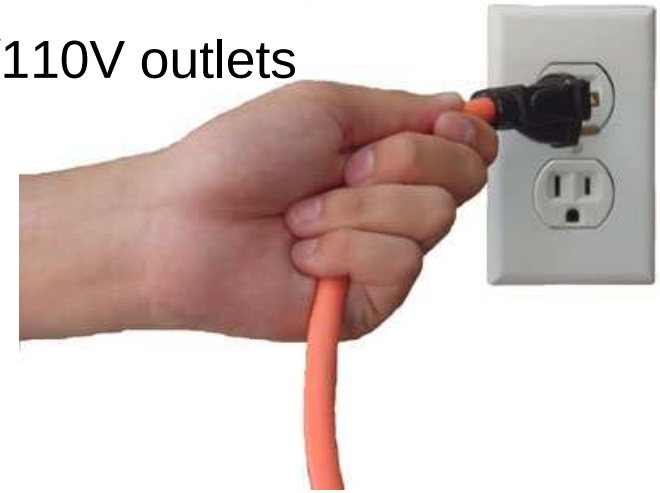
- A 2 kW rooftop solar array provides all the electricity for typical 12,000 mi/yr
  - $12 - 15,000 upfront cost
  - 180 - 260 square feet
  - 6 - 8 year payback
  - >30-year life

PLUG IN AMERICA

No New Infrastructure Needed!

Electricity is our most ubiquitous and economical energy source

- Hundreds of millions of existing 240V/110V outlets



Plug-in Hybrid "charging stations" already exist in most California garages

- Over 500 public vehicle charging sites in service in California today
- Optional fast charging technology, already developed, could be rapidly deployed for under $20,000 per site

PLUG IN AMERICA

New Life for Battery Electrics

- **Tesla – Roadster**
  - **250 mi range**
  - **0-60 mph in 4 sec**
  - **Charging - std 110 or 220v outlet**
  - **First 100 units sold out in <30 days**

- **Redesigned Th!nk City**
  - **Back on track**

- **AC Propulsion – eBox**
  - **Based on Scion xB**
  - **140-180 mi range**
  - **Charging - std 110 or 220v outlet**

- **Commuter Cars – Tango**
  - **Now on the street**

PLUG IN AMERICA

PHEVs are on the way

Saab 9-3 PHEV Biopower Convertible

Daimler-Chrysler Plug-in Hybrid Sprinter Van

- Rapid progress on plug-in hybrids
  - Numerous prototypes and demonstration vehicles
  - Real on-road testing underway
  - Significant durability testing already completed

Plug-in Prius by eDrive Systems

PLUG IN AMERICA

Plug-in Vehicles
Practical, Proven, Ready

- Over 150 million emission-free *consumer* miles driven
- Cleanest personal automotive alternative available
- Only option that allows fueling from home-based renewable energy sources

- Consumer demand already demonstrated
- Continued battery advancements promise longer range BEV and PHEVs
- Plug-in hybrid vehicles provide lower cost entry point for plug-in vehicles and potentially wider initial market

PLUG IN AMERICA